

EH Resident Competency 4.6

Competency 4.6 EH Residents shall demonstrate the ability to conduct inspections on the use of personal protective equipment (PPE).

1. Supporting Knowledge and Skills

- a. Given a type of personal protective equipment, demonstrate the proper use (donning and doffing) of the equipment.
- b. Given a respirator for use, verify that the equipment is in good working order, the routine inspection has been performed, and the respirator is appropriate for the specified activity/environment.
- c. Conduct an assessment of one or more of the following areas of a personal protective equipment program.
 - Written procedures
 - Respirator selection
 - User training
 - Respirator cleaning
 - Respirator storage
 - Inspections

2. Self-Study Activities (corresponding to the intent of the above competency)

Below are two web sites containing many of the references you may need.

Web Sites		
Organization	Site Location	Notes
Department of Energy	http://wastenot.inel.gov/cted/stdguido.html	DOE Standards, Guides, and Orders
OSHA	http://www.osha-slc.gov/	OSHA documents and search engine
U.S. House of Representatives	http://law.house.gov/cfr.htm	Searchable Code of Federal Regulations

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Read Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*; **scan** Subpart I, “Personal Protective Equipment,” of 29 CFR 1910, *Occupational Safety and Health Standards for General Industry*; and **read** 29 CFR 1910.120 (g), Engineering controls, work practices, and personal protective equipment for employee protection, Appendix B, “General Description and Discussion of the Levels of Protection and Protective Gear.”

Note that 29 CFR 1926, *Safety and Health Regulations for Construction*, also contains similar regulations governing the use of PPE in the construction industry.

EXERCISE 4.6-A Describe the various types and intended purpose of personal protective equipment (PPE).

EXERCISE 4.6-B Referring to Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, in the following table, match (from the following list) the appropriate type of respiratory protection to the given limitation:

- Self-contained breathing apparatus (SCBA)
- Positive-pressure, supplied-air respirator (SAR)
- Air-purifying respirator
- Closed-circuit SCBA
- Escape-only SCBA

Matching Respiratory Protection with Limitation	
Disadvantages	Type of Respiratory Protection
At very cold temperatures, scrubber efficiency may be reduced and CO ₂ breakthrough may occur.	
Can only be used against gas and vapor contaminants with adequate warning properties.	
Provides only 5 to 15 minutes of respiratory protection.	
Bulky, heavy, and may impair movement in confined spaces.	
Air line is vulnerable to damage, chemical contamination, and degradation.	

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Have your supervisor or other competent person check you out using the following checklist while you inspect a fully

your supervisor indicates.

SAMPLE PPE INSPECTION CHECKLISTS <small>(From NIOSH)</small>	
PPE	
CLOTHING	
Determine that the clothing material is correct for the specified task at Visually inspect for: <ul style="list-style-type: none">- nonuniform coatings- malfunctioning closures Flex product: <ul style="list-style-type: none">- observe for other signs of shelf deterioration of chemical attack: <ul style="list-style-type: none">- swelling	
During the work task, periodically inspect for: and occur without any visible effects. Tears. Seam discontinuities.	

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SAMPLE PPE INSPECTION CHECKLISTS <small>(From NIOSH)</small>	
PPE	SAT/UNSAT
GLOVES	
Before use: Pressurize glove to check for pinholes. Either blow into glove and then roll gauntlet towards fingers or inflate glove and hold under water. In either case, no air should escape.	
FULLY ENCAPSULATING SUITS	
Before use: Check the operation of pressure relief valves. Inspect the fitting of wrists, ankles, and neck. Check faceshield, if so equipped, for: <ul style="list-style-type: none"> - cracks - crazing - fogginess 	
RESPIRATORS	
SCBA	
Inspect SCBAs: <ul style="list-style-type: none"> - before and after each use - at least monthly when in storage - every time they are cleaned Check all connections for tightness. Check material conditions for: <ul style="list-style-type: none"> - signs of pliability - signs of deterioration - signs of distortion Check for proper setting and operation of regulators and valves (according to manufacturers' recommendations). Check operation of alarm(s). Check faceshields and lenses for: <ul style="list-style-type: none"> - cracks - crazing - fogginess 	

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SAMPLE PPE INSPECTION CHECKLISTS <small>(From NIOSH)</small>	
PPE	SAT/UNSAT
SUPPLIED-AIR RESPIRATORS	
<p>Inspect SARs:</p> <ul style="list-style-type: none">- daily when in use- at least monthly when in storage- every time they are cleaned <p>Inspect air lines prior to each use for cracks, kinks, cuts, frays, and weak areas.</p> <p>Check for proper setting and operation of regulators and valves (according to manufacturers' recommendations).</p> <p>Check all connections for tightness.</p> <p>Check material conditions for:</p> <ul style="list-style-type: none">- signs of pliability- signs of deterioration- signs of distortion <p>Check faceshields and lenses for:</p> <ul style="list-style-type: none">- cracks- crazing- fogginess	
AIR-PURIFYING RESPIRATORS	
<p>Inspect air-purifying respirators:</p> <ul style="list-style-type: none">- before each use to be sure they have been adequately cleaned- after each use- during cleaning- monthly if in storage for emergency use <p>Check material conditions for:</p> <ul style="list-style-type: none">- signs of pliability- signs of deterioration- signs of distortion <p>Examine cartridges or canisters to ensure that:</p> <ul style="list-style-type: none">- they are the proper type for the intended use- the expiration date has not been passed- they have not been opened or used previously <p>Check faceshields and lenses for:</p> <ul style="list-style-type: none">- cracks- crazing- fogginess	

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EXERCISE 4.6-D Referring to Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, identify the general steps to be taken in donning a fully encapsulating suit with SCBA ensemble.

EXERCISE 4.6-E Have your supervisor or other competent person check you out using the following checklist while you don a fully encapsulating suit with SCBA ensemble. Begin as soon as your supervisor indicates.

SAMPLE DONNING PROCEDURES <small>(From NIOSH)</small>		
#	Step	SAT/UNSAT
1.	Inspect the clothing and respiratory equipment before donning (see <i>Inspection</i>).	
2.	Adjust hard hat or headpiece, if worn, to fit user's head.	
3.	Open back closure used to change air tank (if suit has one) before donning suit.	
4.	Standing or sitting, step into the legs of the suit; ensure proper placement of the feet within the suit and then gather the suit around the waist.	
5.	Put on chemical-resistant safety boots over the feet of the suit. Tape the leg cuff over the tops of the boots.	
	If additional chemical-resistant boots are required, put these on now.	
	Some one-piece suits have heavy-soled protective feet. With these suits, wear short, chemical-resistant safety boots inside the suit.	
6.	Put on air tanks and harness assembly of the SCBA. Don the facepiece and adjust it to be secure, but comfortable. Do <i>not</i> connect the breathing hose. Open valve on air tank.	

SAMPLE DONNING PROCEDURES (From NIOSH)		
	Step	SAT/UNSAT
	Perform negative and positive respirator facepiece seal test procedures.	
	palm of the hand or squeeze the breathing tube so it does not pass air, and gently inhale for about 10 seconds. Any inward	
	may be drawn tightly to the face to form a good seal, giving a false indication of adequate fit.	
	the exhalation valve to ensure that a positive pressure can be built up. Failure to build a positive pressure indicates a poor fit.	
	Depending on type of suit:	
	- Put on long-sleeved inner gloves (similar to surgical gloves).	
	done prior to entering the suit).	
	- Additional overgloves, worn over attached suit gloves, may be	
9.	Put sleeves of suit over arms as assistant pulls suit up and over shoulders to ensure unrestricted motion.	
10.		
11.	Raise hood over head carefully so as not to disrupt face seal of	
12.	Begin to secure the suit by closing all fasteners on opening until there is only adequate room to connect the breathing hose. Secure all belts and/or adjustable leg, head, and waistbands.	
	Connect the breathing hose while opening the main valve.	
14.	then make final closure of the suit.	
15.		

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SAMPLE DONNING PROCEDURES (From NIOSH)		
#	Step	SAT/UNSAT
16.	Have assistant observe the wearer for a period of time to ensure that the wearer is comfortable, psychologically stable, and that the equipment is functioning properly.	

EXERCISE 4.6-F Referring to Chapter 8, "Personal Protective Equipment (PPE)," of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, identify the general steps to be taken in doffing a fully encapsulating suit with SCBA ensemble.

EXERCISE 4.6-G Have your supervisor or other competent person check you out using the following checklist while you doff a fully encapsulating suit with SCBA ensemble. Begin as soon as your supervisor indicates.

SAMPLE DOFFING PROCEDURES (From NIOSH)		
If sufficient air supply is available to allow appropriate decontamination before removal:		
#	Step	SAT/UNSAT
1.	Remove any extraneous or disposable clothing, boot covers, outer gloves, and tape.	
2.	Have assistant loosen and remove the wearer's safety shoes or boots.	
3.	Have assistant open the suit completely and lift the hood over the head of the wearer and rest it on top of the SCBA tank.	
4.	Remove arms, one at a time, from suit. Once arms are free, have assistant lift the suit up and away from the SCBA backpack - avoiding any contact between the outside surface of the suit and the wearer's body - and lay the suit out flat behind the wearer. Leave internal gloves on, if any.	
5.	Sitting, if possible, remove both legs from the suit.	

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SAMPLE DOFFING PROCEDURES <small>(From NIOSH)</small>		
If sufficient air supply is available to allow appropriate decontamination before removal:		
#	Step	SAT/UNSAT
6.	Follow procedure for doffing SCBA.	
7.	After suit is removed, remove internal gloves by rolling them off the hand, inside out.	
8.	Remove internal clothing and thoroughly cleanse the body.	
If the low-pressure warning alarm has sounded, signifying that approximately five minutes of air remain:		
1.	Remove disposable clothing.	
2.	Quickly scrub and hose off, especially around the entrance/exit zipper.	
3.	Open the zipper enough to allow access to the regulator and breathing hose.	
4.	Immediately attach an appropriate canister to the breathing hose (the type and fittings should be predetermined.) Although this provides some protection against any contamination still present, it voids the certification of the unit.	
5.	Follow Steps 1 through 8 of the regular doffing procedure above. Take extra care to avoid contaminating the assistant	

EXERCISE 4.6-H Under the oversight of your supervisor and using Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, conduct assessments of the adequacy of DOE's and the contractor's personal protective equipment program. Report your results of both assessments to your supervisor.

3. Summary

(From NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*)

Use of PPE is required by Occupational Safety and Health Administration (OSHA) regulations in 29 CFR 1910 and reinforced by U.S. Environmental Protection Agency (EPA) regulations in 40 CFR 300, which include requirements for all private contractors working on Superfund sites to conform to applicable OSHA provisions and any other federal or state safety requirements deemed necessary by the lead agency overseeing the activities.

No single combination of protective equipment and clothing is capable of protecting against all hazards. Thus, PPE should be used in conjunction with other protective methods. The use of PPE can itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication. In general, the greater the level of PPE protection, the greater are the associated risks. For any given situation, equipment and clothing should be selected that provide an adequate level of protection. Overprotection as well as underprotection can be hazardous and should be avoided.

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4. Exercise Solutions

EXERCISE 4.6-A Describe the various types and intended purpose of personal protective equipment (PPE).

ANSWER 4.6-A

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part Protected	PPE	Purpose
Eyes and face	Face shield	Protects against chemical splashes.
	Splash hood	Protects against chemical splashes.
	Safety glasses	Protect eyes against large particles and projectiles.
	Goggles	Can protect against vaporized chemicals, splashes, large particles, and projectiles.
	Sweat bands	Prevents sweat-induced eye irritation and vision impairment.
Respiratory	Self-contained breathing apparatus	Provides the highest available level of protection against airborne contaminants and oxygen deficiency.
	Supplied-air respirators	Protect against most airborne contaminants.
	Air-purifying respirators	Protect against specific chemicals and up to specific concentrations.
Hands and arms	Gloves and sleeves	Protect hands and arms from chemical contact.
Feet	Safety boots	Protect feet from contact with chemicals and from compression, crushing, or puncture by falling, moving, or sharp objects.
	Disposable shoe or boot covers	Protect safety shoes or boots from contamination.

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Types and Purpose of Personal Protective Equipment (PPE)		
Body Part Protected	PPE	Purpose
Head	Safety helmet	Protects head from blows.
	Hood	Protects against chemical splashes, particulates, and rain.
	Protective hair covering	Protects hair against chemical contamination, entanglement in machinery or equipment, or from interfering with vision and with the functioning of respiratory devices.
Full body	Fully encapsulating suit	Protects against splashes, dust, gases, and vapors.
	Nonencapsulating suit	Protects against splashes, dust, and other materials, but not against gases and vapors.
	Aprons, leggings, and sleeve protectors	Provides additional splash protection of chest, forearms, and legs.

EXERCISE 4.6-B Referring to Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, in the following table, match (from the following list) the appropriate type of respiratory protection to the given limitation:

- Self-contained breathing apparatus (SCBA)
- Positive-pressure, supplied-air respirator (SAR)
- Air-purifying respirator
- Closed-circuit SCBA
- Escape-only SCBA

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ANSWER 4.6-B

Matching Respiratory Protection with Condition	
Disadvantages	Type of Respiratory Protection
At very cold temperatures, scrubber efficiency may be reduced and CO ₂ breakthrough may occur.	Closed-circuit SCBA
Can only be used against gas and vapor contaminants with adequate warning properties.	Air-purifying
Provides only 5 to 15 minutes of respiratory protection.	Escape-only SCBA
Bulky, heavy, and may impair movement in confined spaces.	Self-contained breathing apparatus
Air line is vulnerable to damage, chemical contamination, and degradation.	Positive-pressure, supplied-air respirator

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EXERCISE 4.6-C Have your supervisor or other competent person check you out using the following checklist while you inspect a fully encapsulating suit with SCBA ensemble. Begin as soon as your supervisor indicates.

SAMPLE PPE INSPECTION CHECKLISTS <small>(From NIOSH)</small>	
PPE	SAT/UNSAT
CLOTHING	
<p>Before Use:</p> <p>Determine that the clothing material is correct for the specified task at hand.</p> <p>Visually inspect for:</p> <ul style="list-style-type: none">- imperfect seams- nonuniform coatings- tears- malfunctioning closures <p>Hold up to light and check for pinholes.</p> <p>Flex product:</p> <ul style="list-style-type: none">- observe for cracks- observe for other signs of shelf deterioration <p>If the product has been used previously, inspect inside and out for signs of</p> <p>chemical attack:</p> <ul style="list-style-type: none">- discoloration- swelling- stiffness	
<p>During the work task, periodically inspect for:</p> <p>Evidence of chemical attack such as discoloration, swelling, stiffening, and softening. Keep in mind, however, that chemical permeation can occur without any visible effects.</p> <p>Closure failure.</p> <p>Tears.</p> <p>Punctures.</p> <p>Seam discontinuities.</p>	

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SAMPLE PPE INSPECTION CHECKLISTS <small>(From NIOSH)</small>	
PPE	SAT/UNSAT
GLOVES	
Before use: Pressurize glove to check for pinholes. Either blow into glove and then roll gauntlet towards fingers or inflate glove and hold under water. In either case, no air should escape.	
FULLY ENCAPSULATING SUITS	
Before use: Check the operation of pressure relief valves. Inspect the fitting of wrists, ankles, and neck. Check faceshield, if so equipped, for: <ul style="list-style-type: none"> - cracks - crazing - fogginess 	
RESPIRATORS	
SCBA	
Inspect SCBAs: <ul style="list-style-type: none"> - before and after each use - at least monthly when in storage - every time they are cleaned Check all connections for tightness. Check material conditions for: <ul style="list-style-type: none"> - signs of pliability - signs of deterioration - signs of distortion Check for proper setting and operation of regulators and valves (according to manufacturers' recommendations). Check operation of alarm(s). Check faceshields and lenses for: <ul style="list-style-type: none"> - cracks - crazing - fogginess 	

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SAMPLE PPE INSPECTION CHECKLISTS <small>(From NIOSH)</small>	
PPE	SAT/UNSAT
SUPPLIED-AIR RESPIRATORS	
<p>Inspect SARs:</p> <ul style="list-style-type: none">- daily when in use- at least monthly when in storage- every time they are cleaned <p>Inspect air lines prior to each use for cracks, kinks, cuts, frays, and weak areas.</p> <p>Check for proper setting and operation of regulators and valves (according to manufacturers' recommendations).</p> <p>Check all connections for tightness.</p> <p>Check material conditions for:</p> <ul style="list-style-type: none">- signs of pliability- signs of deterioration- signs of distortion <p>Check faceshields and lenses for:</p> <ul style="list-style-type: none">- cracks- crazing- fogginess	
AIR-PURIFYING RESPIRATORS	
<p>Inspect air-purifying respirators:</p> <ul style="list-style-type: none">- before each use to be sure they have been adequately cleaned- after each use- during cleaning- monthly if in storage for emergency use <p>Check material conditions for:</p> <ul style="list-style-type: none">- signs of pliability- signs of deterioration- signs of distortion <p>Examine cartridges or canisters to ensure that:</p> <ul style="list-style-type: none">- they are the proper type for the intended use- the expiration date has not been passed- they have not been opened or used previously <p>Check faceshields and lenses for:</p> <ul style="list-style-type: none">- cracks- crazing- fogginess	

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ANSWER 4.6-C A supervisor-completed checklist.

EXERCISE 4.6-D Referring to Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, identify the general steps to be taken in donning a fully encapsulating suit with SCBA ensemble.

ANSWER 4.6-D Sample Donning Procedures:

1. Inspect the clothing and respiratory equipment before donning.
2. Adjust hard hat or headpiece if worn, to fit user's head.
3. Open back closure used to change air tank (if suit has one) before donning suit.
4. Standing or sitting, step into the legs of the suit; ensure proper placement of the feet within the suit and then gather the suit around the waist.
5. Put on chemical-resistant safety boots over the feet of the suit. Tape the leg cuff over the tops of the boots.
 - If additional chemical-resistant boots are required, put these on now.
 - Some one-piece suits have heavy-soled protective feet. With these suits, wear short, chemical-resistant safety boots inside the suit.
6. Put on air tanks and harmless assembly of the SCBA. Don the facepiece and adjust it to be secure, but comfortable. Do *not* connect the breathing hose. Open valve on air tank.
7. Perform negative and positive respirator facepiece seal test procedures.
 - To conduct a negative-pressure test, close the inlet part with the palm of the hand or squeeze the breathing tube so it does not pass air, and gently inhale for about 10 seconds. Any inward rushing of air indicates a poor fit. Note that a leaking facepiece may be drawn tightly to the face to form a good seal, giving a false indication of adequate fit.
 - To conduct a positive-pressure test, gently exhale while covering the exhalation valve to ensure that a positive pressure can be built up. Failure to build a positive pressure indicates a poor fit.

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8. Depending on type of suit:
 - Put on long-sleeved inner gloves (similar to surgical gloves).
 - Secure gloves to sleeves, for suits with detachable gloves (if not done prior to entering the suit).
 - Additional overgloves, worn over attached suit gloves, may be donned later.
9. Put sleeves of suit over arms as assistant pulls suit up and over the SCBA. Have assistant adjust suit around SCBA and shoulders to ensure unrestricted motion.
10. Put on hard hat, if needed.
11. Raise hood over head carefully so as not to disrupt face seal of SCBA mask. Adjust hood to give satisfactory comfort.
12. Begin to secure the suit by closing all fasteners on opening until there is only adequate room to connect the breathing hose. Secure all belts and/or adjustable leg, head, and waistbands.
13. Connect the breathing hose while opening the main valve.
14. Have assistant first ensure that wearer is breathing properly and then make final closure of the suit.
15. Have assistant check all closures.
16. Have assistant observe the wearer for a period of time to ensure that the wearer is comfortable, psychologically stable, and that the equipment is functioning properly.

EXERCISE 4.6-E Have your supervisor check you out using the following checklist while you don a fully encapsulating suit with SCBA ensemble. Begin as soon as your supervisor indicates.

ANSWER 4.6-E A supervisor-completed checklist.

EXERCISE 4.6-F Referring to Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, identify the general steps to be taken in doffing a fully encapsulating suit with SCBA ensemble.

ANSWER 4.6-F A supervisor-completed checklist.

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EXERCISE 4.6-G Have your supervisor check you out using the following checklist while you doff a fully encapsulating suit with SCBA ensemble. Begin as soon as your supervisor indicates.

ANSWER 4.6-G A supervisor-completed checklist.

EXERCISE 4.6-H Under the oversight of your supervisor and using Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, conduct assessments of the adequacy of DOE’s and the contractor’s personal protective equipment program. Report your results of both assessments to your supervisor.

ANSWER 4.6-H Your supervisor will evaluate how well you conducted the assessments and the adequacy of your specific results.